DOCUMENT RESUME

ED 071 241 EC 050 516

AUTHOR	Danner, Fred W.; Taylor, Arthur M.
TITLE	Pictures and Relational Imagery Training in Children's Learning. Research Report #29.
INSTITUTION	Minnesota Univ., Minneapolis. Research, Development, and Demonstration Center in Education of Handicapped Children.
SPONS AGENCY	Bureau of Education for the Handicapped (DHEW/OE), Washington, D.C.
BUREAU NO	332189
PUB DATE	Dec 71
GRANT	OEG-09-332189-4533(032)
NOTE	40p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Association (Psychological); *Associative Learning; *Childhood; *Imagery; Learning Processes; Memory; *Recall (Psychological); Symbolic Learning; *Training Techniques

ABSTRACT

The study was designed to developmentally assess the effect of relational imagery training, unitized pictorial relations, and the combination of both on the recall of noun triplets by 120 first, third and sixth graders. In the unitized picture condition, relations were imposed by the experimenter, whereas the relational imagery training condition required that the child generate his own relations. Mean recall under the three experimental conditions was found to be from two to six times greater than that of a control group for grades one, three, and six. Relational imagery training (the generation of pictorial relations) was reported to be highly effective even with first grade children. By sixth grade, subject-generated relations provided higher mean recall than experimenter-imposed relations. It was suggested that encouraging young children to generate relations might help them to become more confident in their ability to improve their own learning efficiency. (For a related paper describing the above study, see ED 066 757). (Author/GW)

ED 071241

FILMED FROM BEST AVAILABLE COPY

PROJ 332189
BEH
EC

RESEARCH REPORT #29

Project No. 332189
Grant No. OE-09-332189-4533 (032)

PICTURES AND RELATIONAL IMAGERY TRAINING IN CHILDREN'S LEARNING[1]

Fred W. Danner and Arthur M. Taylor
University of Minnesota
Research, Development and Demonstration
Center in Education of Handicapped Children
Minneapolis, Minnesota

December 1971

Department of Health, Education and Welfare

U. S. Office of Education

Bureau of Education for the Handicapped

EC 050 516 E

TECHNICAL REPORTS

University of Minnesota Research, Development and Demonstration
Center in Education of Handicapped Children

(Place of publication shown in parentheses where applicable.)

1. D. Feldman. The Fixed-Sequence Hypothesis: Individual Differences in the Development of School Related Spatial Reasoning. Research Report #1, March, 1970.

2. D. Feldman & W. Markwalder. Systematic Scoring of Ranked Distractors for the Assessment of Piagetian Reasoning Levels. Research Report #2, March, 1970. (Educational and Psychological Measurement, 1971, 31, 347-362.)

3. D. Moores. Evaluation of Preschool Programs: An Interaction Analysis Model. Occasional Paper #1. April, 1970. (Keynote Address, Diagnostic Pedagogy, International Congress on Deafness. Stockholm, August 1970, also presented at American Instructors of the Deaf Annual Convention, St. Augustine, Florida, April, 1970).

4. J. Turnure. Reactions to Physical and Social Distractors by Moderately Retarded Institutionalized Children. Research Report #3. June, 1970. Journal of Special Education, 1970, 4, 283-294.

5. J. Turnure, J. Rynders, & N. Jones. Effectiveness of Manual Guidance, Modeling & Trial & Error Learning for Inducting Instrumental Behavior in Institutionalized Retardates. Research Report #4. June, 1970.

6. J. Turnure & M. Walsh. The Effects of Varied Levels of Verbal Mediation on the Learning & Reversal of Paired-Associates by Educable Mentally Retarded Children. Research Report #5. June, 1970. (Study I: American Journal of Mental Deficiency, 1971, 76, 60-67. Study II: American Journal of Mental Deficiency, 1971 in press).

7. R. Martin & L. Berndt. The Effects of Time-Out on Stuttering in a 12-year-old Boy, Research Report #6. July, 1970. (Exceptional Children, 1970, 37, 303-304).

8. J. Turnure, M. Thurlow, & S. Larsen. Syntactic Elaboration in the Learning & Reversal of Paired-Associates by Young Children. Research Report #7, January, 1971.

9. D. Feldman & J. Bratton. On the Relativity of Giftedness: An Empirical Study. Research Report #8. Aug., 1970. (American Educational Research Annual Conference, N. Y., February, 1971.

10. R. Rubin & B. Balow. Prevalence of School Learning & Behavior Disorders in a Longitudinal Study Population. Research Report #9. October, 1970. (Exceptional Children, 1971, 38, 293-299).

11. R. Rubin. Sex Differences in Effects of Kindergarten Attendance on Development of School Readiness and Language Skills. Research Report #10. October, 1970. (Elementary School Journal - in press).

12. R. Bruininks & W. Lucker. Change and Stability in Correlations Between Intelligence and Reading Test Scores Among Disadvantaged Children. Research Report #11. October, 1970. (Journal of Reading Behavior, 1970, 2, 295-305)

13. R. Bruininks. Teaching Word Recognition to Disadvantaged Boys with Variations in Auditory and Visual Perceptual Abilities. Research Report #12. November, 1970. (Journal of Learning Disabilities, 1970, 3, 30-39)

14. R. Bruininks & C. Clark. Auditory and Visual Learning in First Grade Educable Mentally Retarded Normal Children. Research Report #13. November, 1970. (American Journal of Mental Deficiency, in press)

15. R. Bruininks & C. Clark. Auditory and Visual Learning in First-, Third-, and Fifth-Grade Children. Research Report #14. November 1970.

16. D. Moores. Education of the Deaf in the United States*, Occasional Paper #2. November, 1970. (Moscow Institute of Defectology, 1971, Published in Russian)

17. J. Rynders. Industrial Arts for Elementary Mentally Retarded Children: An Attempt to Redefine and Clarify Goals. Occasional Paper #3. January, 1971.

18. D. Feldman. Map Understanding as a Possible Crystallizer of Cognitive Structures. Occasional Paper #4. January, 1971. (American Educational Research Journal, 1971, 3, 484-502)

19. P. Broen & G. Siegel. Variations in Normal Speech Disfluencies. Research Report #15. January, 1971 (Language & Speech, in press)

20. D. Feldman, B. Marrinan, & S. Hartfeldt. Unusualness, Appropriateness, Transformation and Condensation as Criteria for Creativity". Research Report #16. February, 1971. (American Educational Research Association Annual Conference, New York, February 1971)

21. D. Moores. Neo-Oralism and the Education of the Deaf in the Soviet Union. Occasional Paper #5. February, 1971. (Exceptional Children, January, 1972)

ED 071241

RESEARCH REPORT #29

Project No. 332189
Grant No. OE-09-332189-4533 (032)

PICTURES AND RELATIONAL IMAGERY TRAINING IN CHILDREN'S LEARNING[1]

Fred W. Danner and Arthur M. Taylor

Research, Development and Demonstration
Center in Education of Handicapped Children
University of Minnesota
Minneapolis, Minnesota

December 1971

The research reported herein was performed pursuant to a grant from the Bureau of Education for the Handicapped, U.S. Office of Education, Department of Health, Education, and Welfare to the Center for Research and Development in Education of Handicapped Children, Department of Special Education, University of Minnesota. Contractors undertaking such projects under government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions states do not, therefore, necessarily represent official position of the Bureau of Education for the Handicapped.

Department of Health, Education and Welfare

U. S. Office of Education

Bureau of Education for the Handicapped

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY

RESEARCH AND DEVELOPMENT CENTER
IN EDUCATION OF HANDICAPPED CHILDREN
Department of Special Education
Pattee Hall, University of Minnesota, Minneapolis, Minnesota 55455

The University of Minnesota Research, Development and Demonstration Center in Education of Handicapped Children has been established to concentrate on intervention strategies and materials which develop and improve language and communication skills in young handicapped children.

The long term objective of the Center is to improve the language and communication abilities of handicapped children by means of identification of linguistically and potentially linguistically handicapped children, development and evaluation of intervention strategies with young handicapped children and dissemination of findings and products of benefit to young handicapped children.

Pictures and Relational Imagery Training in Children's Learning[1]

Fred W. Danner and Arthur M. Taylor

Abstract

The effects of interrelated (unitized) pictures, training in the generation of imaginal relations, and the combination of training and unitized pictures on the recall of noun triplets were developmentally assessed. Mean recall under these three conditions was from two to six times greater than that of a control group in grades one, three, and six. Relational imagery training (the generation of pictorial relations) was highly effective even with first grade children and by sixth grade, subject-generated relations provided higher mean recall than experimenter-imposed relations. It was suggested that encouraging young children to seek out and generate relations might help them become aware of and more confident in their ability to improve their own learning efficiency.

Pictures and Relational Imagery Training in Children's Learning[1]

Fred W. Danner and Arthur M. Taylor

It has been demonstrated that associative recall is facilitated when subjects are presented with unitized, interacting pictures of nouns (Davidson & Adams, 1970; Milgram, 1967; Reese, 1965; Rohwer, 1967) and when they actively seek out and construct verbal or imaginal relations between them (Bobrow & Bower, 1969; Bower & Winzenz, 1970). However, there appears to be a developmental trend in the effectiveness of inferred mental imagery as an aid to associative recall (Reese, 1970a). This is reflected both in studies which suggest an increasing capacity with age to benefit from pictorial materials (Rohwer, 1970) and in those which indicate a similar trend in the capacity to generate relational or "dynamic" images (Montague, 1970; Wolff & Levin, 1971).

The developmental trends suggested above may, in part, indicate a misunderstanding of the task by the younger children rather than an inability to utilize or generate relations between nouns. For example, Reese (1970c) has speculated that the inability of young children to benefit greatly from pictorial interactions may be due to their failure to "read" or attend to relations. This failure to attend to relations might also explain the poor paired-associate recall of young subjects (Grade one and below) instructed to generate relational images since they may focus on the individual items rather than their potential interaction.

It seems plausible that the child's attention could be focused

on relations between items by training him to construct relations. However, attempts at relational training have met with mixed success. Rohwer, Ammon, & Levin (1971) attempted to train preschool, kindergarten, and second-grade children to construct sentences or interacting images with noun pairs. The pairs were presented verbally, on videotape, as objects, and as cut-outs since Rohwer et.al.'s objective was to train the children to utilize verbal and imaginal elaborations with varying types of input. Training facilitated recall of the noun pairs with only part of the second-grade sample and proved ineffective with preschool and kindergarten children. It is possible that the diversity of training and presentation methods confused the children rather than produced a set to relate the noun pairs.

A different approach to relational training was taken by Wolff & Levin (1971) in their investigation of the link between motor activity and relational imagery production. They used small toys as stimulus and response items in a paired-associate task and found that kindergarten and first-grade children instructed to manipulate the pairs of toys (i.e., "make them play together") had significantly greater recognition scores than those instructed to form a mental image of the toys in each pair playing together. Wolff & Levin concluded that manipulation permitted the formation of dynamic images by children who were otherwise unable to form them. However, the subjects who were instructed to form mental images may simply not have understood what was expected of them.

Regardless of the role of motor activity in the genesis of imagery, a study by Taylor, Gallistel, & Trautz (1972, in press) suggests that

manipulation is not necessary for imagery formation in seven-year-old children. Normal and low-ability first-grade children were presented with pictured nouns and were trained to generate relational images through example, practice, and feedback. This training dramatically facilitated their subsequent paired-associate recall compared to a control group instructed to repeat the pairs. Apparently, training which focuses on one relational strategy (imagery) and one method of presentation (pictorial) clarifies the subject's task and more adequately assesses his competence with a relational strategy than does diversified training such as that used by Rohwer, et. al. (1971).

The present study is an expansion of the Taylor, et al. study designed to developmentally assess the effect of relational imagery training, unitized pictorial relations, and the combination of both on the recall of noun triplets. It was hypothesized that all three of the experimental conditions defined by these variables would facilitate recall relative to a control group at each age level tested.

Two of the above experimental conditions represent quite different approaches for providing useful relations for children. In the unitized picture condition, relations are imposed by the experimenter, whereas the relational imagery training condition requires that the child generate his own relations. Previous research comparing the effects of imposed and self-generated relations on recall suggests the following trend: imposed relations superior at age five (Rohwer, et al., 1971), the two sources of

relations equally effective from grades one through eleven (Bean & Rohwer, 1970 described in Rohwer, 1971), and a dramatic superiority of self-generated relations for college-students (Bobrow & Bower, 1969; Bower & Winzenz, 1970). Bower and his associates attribute this superiority of self-generated relations to the active processing involved in the construction of idiosyncratic relations, but it is difficult to understand why the superiority of active processing only becomes evident in college subjects.

Flavell's recent discussion of cognitive-developmental stages (Flavell, 1971) raises two issues which relate to this assessment problem. First, he concluded that the development of cognitive "items" (a generic expression for any sort of cognitive acquisition) is characteristically gradual rather than abrupt and second, that the assessment and comparison of two cognitive items on two different tasks can be misleading if one of the tasks is more demanding than the other. Applying this developmental perspective to the comparison of self-generated and imposed relations, one might predict that (a) regardless of when it first appears, the ability to construct relations develops gradually and (b) performance constraints such as misunderstanding, lack of practice, and not enough time to think may distort the comparison between self-generated and imposed relations. In order to reduce these performance constraints and to discover at what ages relational imagery training might be functional, the training in the present study provides a clear specification of the task demands by allowing practice and providing feedback on several examples.

Two recent studies which utilized this careful instructional technique indicate that sixth-grade subjects are quite proficient at generating and remembering imaginal relations (Levin & Kaplan, in press; Taylor & Whitely, 1971). Furthermore, Rohwer (1971) presents evidence which suggests that the critical transition age for the spontaneous and deliberate use of relational strategies is approximately age 12. It was therefore hypothesized that by this age (i.e., sixth grade) relational imagery training would facilitate recall more than the presentation of unitized pictures.

The third hypothesis was that the combination of relational imagery training and imposed relations would facilitate recall more than either condition separately, at least for the younger children. This hypothesis was based on the assumption that it would be easier to focus the young child's attention on the relations depicted in imposed pictures, than to rely either on his spontaneous attention to the relations or his ability to quickly generate a series of equally good relations.

METHOD

Subjects. A total of 120 suburban school children -- 20 boys and 20 girls from each of grades one, three, and six -- served as Ss[2]. The mean age for each grade was as follows (in years--months): Grade one, 7-3; Grade three, 9-1; Grade six, 12-2. Standardized test scores were unavailable, therefore the sample was selected from a list of the middle-ability students which was prepared by the teachers.

Materials. Fifty-four pictures were selected from a pool of 500

pictures of concrete nouns,[3] and pilot tests indicated that the youngest children in the sample were familiar with all of them. The 54 nouns were divided into 18 three-picture sets (i.e., triplets). Triplets were used rather than pairs under the assumption that larger associative units would be more sensitive to the changes in associative strategies which the unitized pictures and relational imagery training were designed to produce (cf., Taylor & Whitely, 1971).

Two versions of the three-picture sets were constructed. (See Appendix A for the complete list of noun triplets and sample pictures of the two versions). In one version, the three pictured nouns in each set were incorporated into a unitized interacting scene. This integration of pictures resulted in many unrealistic, cartoon-like interactions (e.g., an elephant driving a car over a football) which seemed ideal for accentuating relations. The second version of the three-picture sets consisted of separate drawings of the nouns in the same left-to-right sequence. These separate drawings also had a cartoon-like quality but without the interaction. All of the three-picture sets, both unitized and separated were on 5 x 8 inch cards.

A set of 18 one-item pictures was also prepared for the cued-recall test. One picture was copied from each of the 18 separated sets such that six cues each were selected from the left, right, and middle positions.

Design. A 2 x 3 x 4 factorial design was used. Boys and girls from each of the three grades (one, three, and six) were assigned to one of four conditions (relational imagery training, unitized

pictures, the combination of training and unitized pictures, or a control group receiving neither training nor unitized pictures).

Procedure. All Ss were individually tested by one of three Es -- two males and one female. (See Appendix B for detailed instructional procedures). Each S was told that he was to play a game with pictures and was asked to try to remember them. At this point, S was given different instructions dependent on his condition. Ss in the combined condition were shown three practice sets of unitized noun triplets. As each set was presented, E named the three items, said that they were doing something together, and asked S to describe the interaction. If S's description focused on the items rather than their interaction, he was asked specific questions about the relations between items. After the first set, E removed the picture, asked S to recall the interaction, and cued his recall of two of the items with a picture of the third. On the second and third practice sets, S was asked not only to describe the interaction but also to make a quick sketch of it from memory and to describe the interaction in his drawing. In this way, E was able to direct and assess S's attention to pictorial relations.

S's receiving relational imagery training were required to generate and draw their own unitized pictures while viewing separated pictures. On the first practice set, a unitized picture served as a model and, as soon as the interaction had been discussed, recall was cued as in the combined condition. On practice sets two and three, S received as much encouragement and correction as was necessary to produce an interacting scene. Thus, S's mental task -- the generation of relations -- was

externalized and clarified.

Ss in the unitized and control conditions practiced on the first three sets but received no training. Ss in the unitized condition were presented with the first unitized picture for 20 seconds and were asked to remember it. S's recall of two of the items was then cued with a picture of the third. Practice sets two and three were then presented for 20 seconds each with the same instruction to remember them. The same practice procedure was used for control Ss except that three separated-picture sets were presented. Thus, the unitized condition provided an opportunity (but no encouragement) for attention to imposed relations while the control condition left Ss totally on their own with separated pictures.

Because of the drawing and discussions in the combined and relational imagery training conditions, less time was spent with each S in the unitized and control conditions. It was not readily apparent how to fill this time gap without distracting the unitized and control condition children from the learning task so no activity was interpolated between the practice and experimental trials.

After the initial training or practice session, a cued-recall test of the three practice sets was administered to each S with a maximum of 15 seconds allowed for each response. S was praised for his good memory and was asked to play the game with some more pictures. Each S was given specific instructions on how to proceed dependent on his condition. Ss in the combined condition were asked to "try to remember what the things are doing together." Ss who had received relational imagery training were asked to "try to

make up a picture of the three things doing something together" but were not asked to draw. Ss in the unitized picture and control conditions were simply asked to remember which pictures went together. The 15 experimental sets were then presented to each S at a 20 sec. rate. Immediately after presentation of all 15 sets, a recall test using the single-item pictures as cues was administered. A maximum of 15 seconds was allowed for a response to each cue.

Each S was questioned about his memory strategies immediately after the recall test. He was asked a general question about what he had done when he looked at the pictures and several specific questions about his approach to particular triplets.

RESULTS

There were no significant main or interaction effects due to sex of S, therefore the recall data for boys and girls were combined. The mean and standard deviation of recall as a function of condition and grade-level is shown in Table 1.

Insert Table 1 about here

Figure 1 graphically presents the same mean recall information.

Insert Figure 1 about here

Table 2 presents t tests of the orthogonal contrasts which were derived from the three hypotheses. The preselected significance level

for all tests was .05.

Insert Table 2 about here

Hypothesis one contrasted the three experimental conditions with the control condition. As can be seen in Figure 1, mean recall in the three experimental conditions was from two to six times higher than in the corresponding control conditions. Multiple *t* tests confirmed that all of the experimental conditions at each age were superior to their respective control conditions.

The second contrast compared relational imagery training with unitized pictures. In grade one, recall was slightly but not significantly lower in the relational imagery training condition. In grade three, this was reversed i.e., recall was slightly higher in the training condition. By grade six, recall with training was significantly superior to that of unitized pictures as predicted.

The contrast for hypothesis three was between the combined condition and the average of the training and unitized picture conditions. As predicted, the increment in recall due to the combination of training and unitized pictures was evident in grades one and three and diminished by grade six. A further breakdown of this comparison revealed that the combined condition was superior to the training condition in grade one ($t = 1.76$, one-tail) and was superior to the unitized picture condition in grades three ($t = 2.85$, one-tail) and six ($t = 1.75$, one-tail).

The same data were also analyzed developmentally. This analysis

showed that recall increased significantly from grade one to grade six in both the relational imagery training and control conditions (t = 3.69 and 2.93, respectively). However, there was no significant age trend in recall for either the unitized picture condition or the combined condition (see Figure 1).

DISCUSSION

The major finding was that all three experimental conditions--relational imagery training, unitized pictures, and the combination of both -- greatly facilitated recall. The following discussion considers developmental trends in these conditions, comparisons between conditions, and the potential educational benefits of relational training.

Contrary to most previous studies, no support was found for a developmental trend in the effectiveness of unitized pictures. Reese (1970b) also failed to obtain an age trend although his Ss only ranged in age from 40 to 64 months. In the present study, unitized pictures were highly effective at all three ages, but especially with the first grade children. It is possible that the lack of an age trend was an artifact of the materials. In order to fairly assess the relational-strategy potentials of the youngest children in the sample, the materials were designed to appeal to them. The first-graders were especially amused by the depicted interactions and this probably helped them attend to the relations. However, the fact that there was virtually no recall increment from grade three to grade six suggests that the lack of an age trend was not entirely artifactual.

Although there was a significant developmental trend in the effectiveness of relational imagery training, inspection of the individual recall scores indicated that all of the children who received relational training were using relatively efficient memory strategies. In fact, there were only two instances where recall scores from the control condition overlapped those of the age-equivalent training condition. Furthermore, as Bugelski, Kidd & Segmen (1968) previously noted with college Ss, the children in the training condition eagerly recalled their active, and often humorous, elaborative constructions during post-test questioning. Evidently, even the first-grade children were able to effectively utilize a relational strategy to improve their recall. Comparable training procedures would probably reveal that other seven-year-old children, as well, are not deficient in relational imagery skills (cf. Montague, 1970) and do not need to manipulate objects (cf. Wolff and Levin, 1971) in order to construct functional relations.

The only deficiency the young Ss in the present study exhibited was one of spontaneous production (Flavell, Beach, & Chimsky, 1966). Among the control Ss, no grade-one S indicated that he had used a relational strategy; one grade-three S reported that he had generated sentences; and two-grade-six Ss reported that they had generated stories to relate the items. It is interesting to note that the latter two Ss recalled 12 and 29 items apiece while the other eight control Ss recalled an average of six items apiece. The age trend in the control condition might therefore be due, at least in part, to an increase with age in the spontaneous use of relational strategies.

Rohwer (1971) concluded from similar evidence that age 12 is the best time to begin teaching relational strategies and that we should not waste our efforts on younger children. The data from the sixth graders in the present study might be taken as support for this view. Sixth graders both had the highest recall with training and were the only group which appear to have generated more effective relations than those which were presented in the unitized picture condition. However, the fact that relational imagery training was so effective even with first-grade Ss indicates that we might start training much earlier than age 12.

It is significant that sixth graders recalled more items when they generated their own relations than when relations were supplied. This is the first demonstration of superior recall with self-generated relations using Ss younger than college age. It could be argued that two procedural factors contributed to this finding. First, Ss had more time to generate relations than has been allowed in previous studies. However, consideration of three related points would suggest that time was not, and should not be a critical factor. First, children are usually given as much time as they need when they are asked to construct relations (e.g., in a classroom task). Second, the relations were between noun triplets rather than the traditional pairs. And finally, even the 15-20 seconds per triplet may not have been time enough to allow each subject to construct an adequate relation for each triplet. In light of these considerations, it seems that the benefits of self-generated relations relative to imposed relations, if anything, were underestimated in the present study.

The procedural factor other than time which might have contributed to the superiority of self-generated relations is the nature of the imposed relations (i.e., unitized pictures). It could be argued that the unitized pictures were of less relevance for the sixth grade children. If such were the case, the unitized pictures would not have substantially improved the sixth grader's recall. However, as Figure 1 shows, mean recall with unitized pictures was nearly double that of the control condition, and this in turn makes the small but significant additional increase in the relational training condition more noteworthy.

Another important comparison is that between the combined condition and its two components. With only one exception (grade six relational training), mean recall was higher in the combined condition than in the relational training or unitized picture conditions. This leads to the following speculations: 1) as noted earlier, Ss in the relational training condition may have had difficulty generating effective relations under time pressure thus lowering their recall relative to the combined condition and 2) even sixth-graders cannot be expected to derive optimal benefit from imposed relations without some instruction which focuses their attention on relations rather individual items.

While providing relations greatly improved recall at all three ages, encouraging the children to actively seek out and construct relations between nouns was the crucial factor in the training procedures. With further refinement, such procedures might be incorporated into classroom instruction so that young children might

become more aware of and confident in their ability to improve their own learning efficiency. However, it seems that attempts to incorporate these materials in the classroom must first move toward substantially longer, but tightly controlled, interventions. One such attempt (Ammon & Ammon, 1971) focused on teaching functional vocabulary to young children. Although the Ammon & Ammon study met with limited success, this may be due to the emphasis on elaborative materials without the benefit of elaboration training. In another study, Taylor & Riegel (1972) conducted an extensive classroom intervention with retarded children in which they trained children to actively seek out and construct relations between noun pairs, as well as pre-reading and arithmetic items. These researchers report improvement in elaboration and other organizational skills from such training, but suggest the need for more controlled evaluation of the training.

REFERENCES

Ammon, P. R. & Ammon, M. S. Effects of Training in vocabulary versus sentence construction. Journal of Educational Psychology, 1971, 62, 421-426.

Bobrow, S. A., & Bower, G. H. Comprehension and recall of sentences. Journal of Experimental Psychology, 1969, 80, 455-461.

Bower, G. H., & Winzenz, D. Comparison of associative learning strategies. Psychonomic Science, 1970, 20, 119-120.

Bugelski, B. R., Kidd, E., & Segmen, J. Image as a mediator in one-trial paired-associate learning. Journal of Experimental Psychology, 1968, 76, 69-73.

Davidson, R. E., & Adams, J. F. Verbal and imagery processes in children's paired-associate learning. Journal of Experimental Child Psychology, 1970, 9, 429-435.

Flavell, J. H. Stage-related properties of cognitive development. Cognitive Psychology, 1971, in press.

Flavell, J. H., Beach, D. R., & Chinsky, J. M. Spontaneous verbal rehearsal in a memory task as a function of age. Child Development, 1966, 37, 283-299.

Levin, J. R., & Kaplan, S. A. Imaginal facilitation of paired-associate learning: A limited generalization? Journal of Educational Psychology, in press.

Milgram, N. A. Verbal context versus visual compound in paired-associate learning by children. Journal of Experimental Child Psychology, 1967, 5, 597-603.

Montague, R. B. The effect of mediational instructions on associative skills of first grade inner-city children. Paper presented at meeting of the American Educational Research Association, Minneapolis, March, 1970.

Reese, H. W. Imagery in paired-associate learning in children. Journal of Experimental Child Psychology, 1965, 2, 290-?96.

Reese, H. W. (Chm.) Imagery in children's learning: A symposium. Psychological Bulletin, 1970, 73, 383-421. (a)

Reese, H. W. Imagery in children's paired-associate learning. Journal of Experimental Child Psychology, 1970, 9, 174-178. (b)

Reese, H. W. Imagery and contextual meaning. Psychological Bulletin, 1970, 73, 404-414. (c)

Rohwer, W. D., Jr. Social class differences in the role of linguistic structures inpaired-associate learning: Elaboration and learning proficiency. (Basic Research Project N 5-0605, Contract No. OE 6-10-273), Washington D.C. : United States Office of Education, 1967.

Rohwer, W. D., Jr. Images and pictures in children's learning: Research results and educational implications. Psychological Bulletin, 1970, 73, 393-403.

Rohwer, W. D., Jr. Prime time for education: Early childhood or adolescence? Harvard Educational Review, 1971, 41, 316-341.

Rohwer, W. D., Jr., Ammon, M. S., & Levin, J. R. Learning efficiency and elaboration training among four-and five-year-old children. (Final Report, OEO Contract No. B 99-4776), 1971.

Taylor, A. M., Gallistel, E. & Troutz, S. Analysis of the potential for the development of elaboration strategies with young learning disabled children. Interim Report of Research, Development and Demonstration Center in the Education of Handicapped Children. Minneapolis, 1972, in preparation.

Taylor, A. M. & Riegel, R. H. Memory strategies in the classroom: the St. Paul Strategies Instructional Program. Interim Report of the Research, Development and Demonstration Center in Education of Handicapped Children. Minneapolis, 1972, in preparation.

Taylor, A. M., & Whitely, S. E. Imagery as a relational organizer in children's associative learning: Spatial and semantic relations. Paper presented at the meeting of the Society for Research in Child Development, Minneapolis, April, 1971.

Wolff, P., & Levin, J. R. The role of overt activity in children's imagery production. (Published by the Wisconsin Research and Development Center for Cognitive Learning, Center No. C-03/Contract No. OE 5-10-154), 1971.

Footnotes

[1]The first author conducted this study as an NSF graduate fellow at the Institute of Child Development. The authors wish to thank Dr. John H. Flavell and Dr. James E. Turnure for critically evaluating an earlier version of this paper. This paper is to be presented at the annual meeting of the American Educational Research Association, Chicago, April, 1972.

[2]The authors wish to thank the administrators, teachers, and students of the Mounds View Public School System for their help and cooperation. Special thanks to Mary Bounds and Henry Taxis for helping to collect the data.

[3]The pictures were adapted from "Word Making Cards," a product of Word Making Productions, Box 305, Salt Lake City, Utah.

Table 1

Recall Mean and Standard Deviation as a Function of Condition and Grade-level

	Conditions			
Grade	Unitized Pictures	Relational Training	Combined	Control
1	18.5(4.4)	16.7(5.0)	20.3(4.1)	3.2(2.1)
3	16.6(6.8)	19.1(5.9)	21.5(3.6)	5.0(3.2)
6	17.0(6.4)	22.6(5.2)	21.4(4.7)	8.8(8.2)

Note: Standard deviations are in parentheses.

Table 2

t Tests of Orthogonal Contrasts

	Hypothesis		
Grade	1	2	3
1	10.38**	1.00	1.73*
3	7.52**	1.09	1.84*
6	5.02**	1.99*	.66

* $p < .05$ (1-tail)

** $p < .001$ (1-tail)

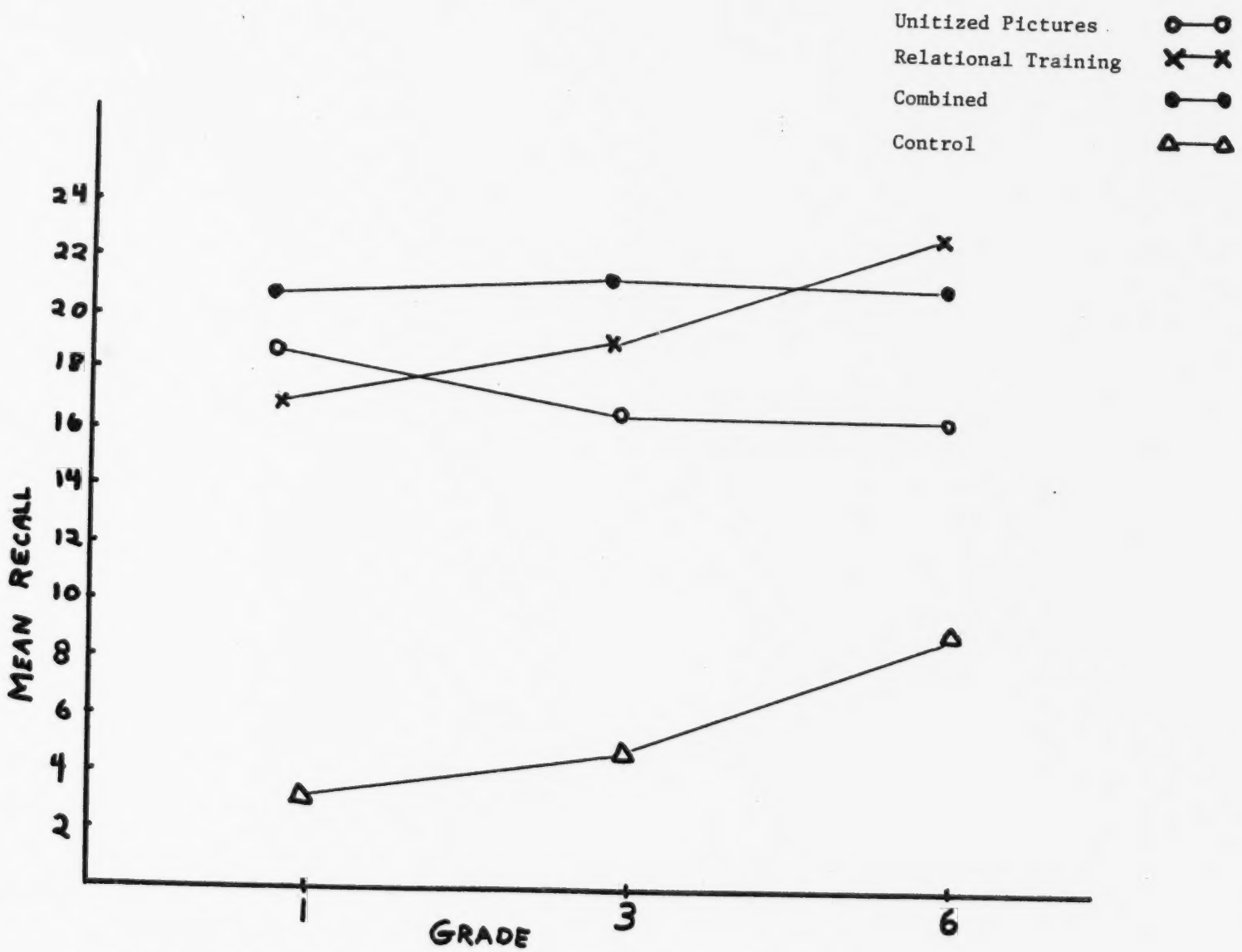
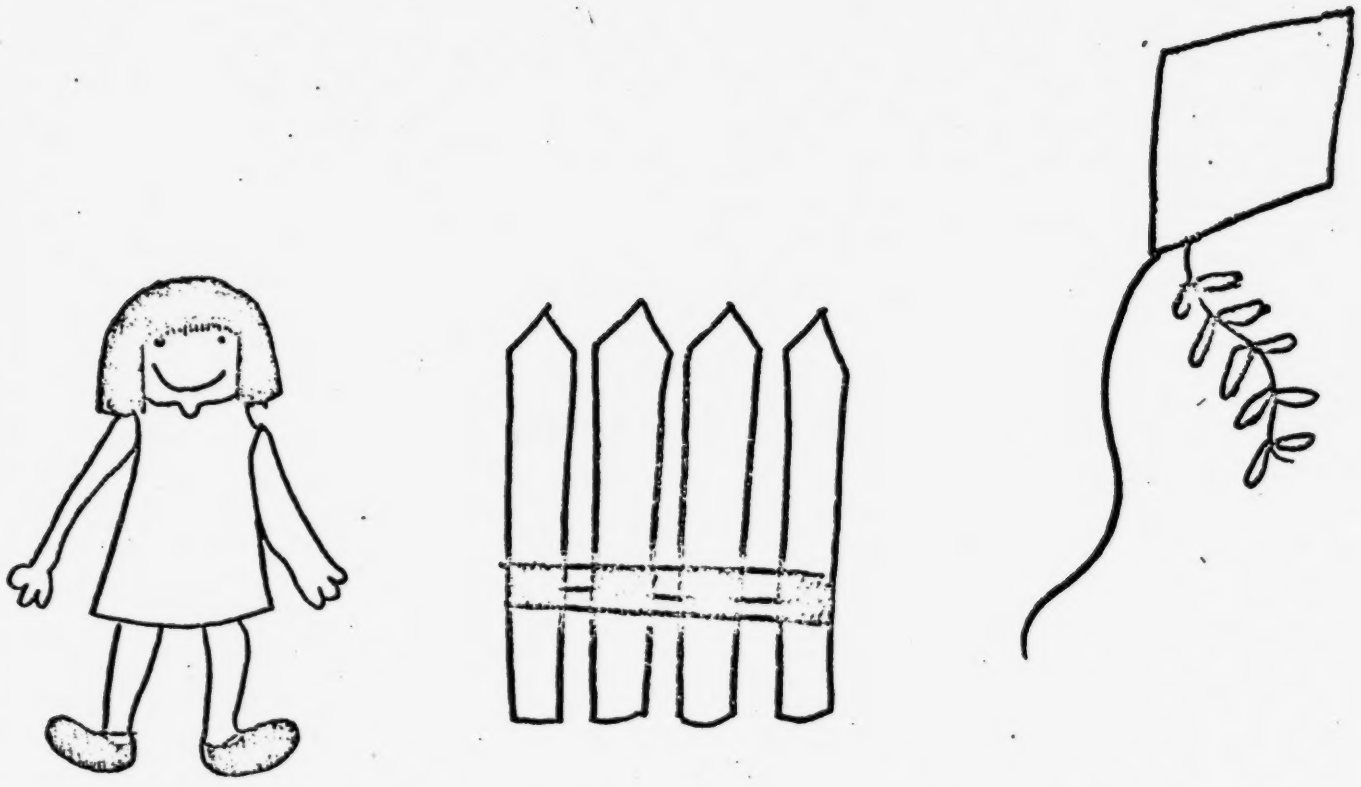
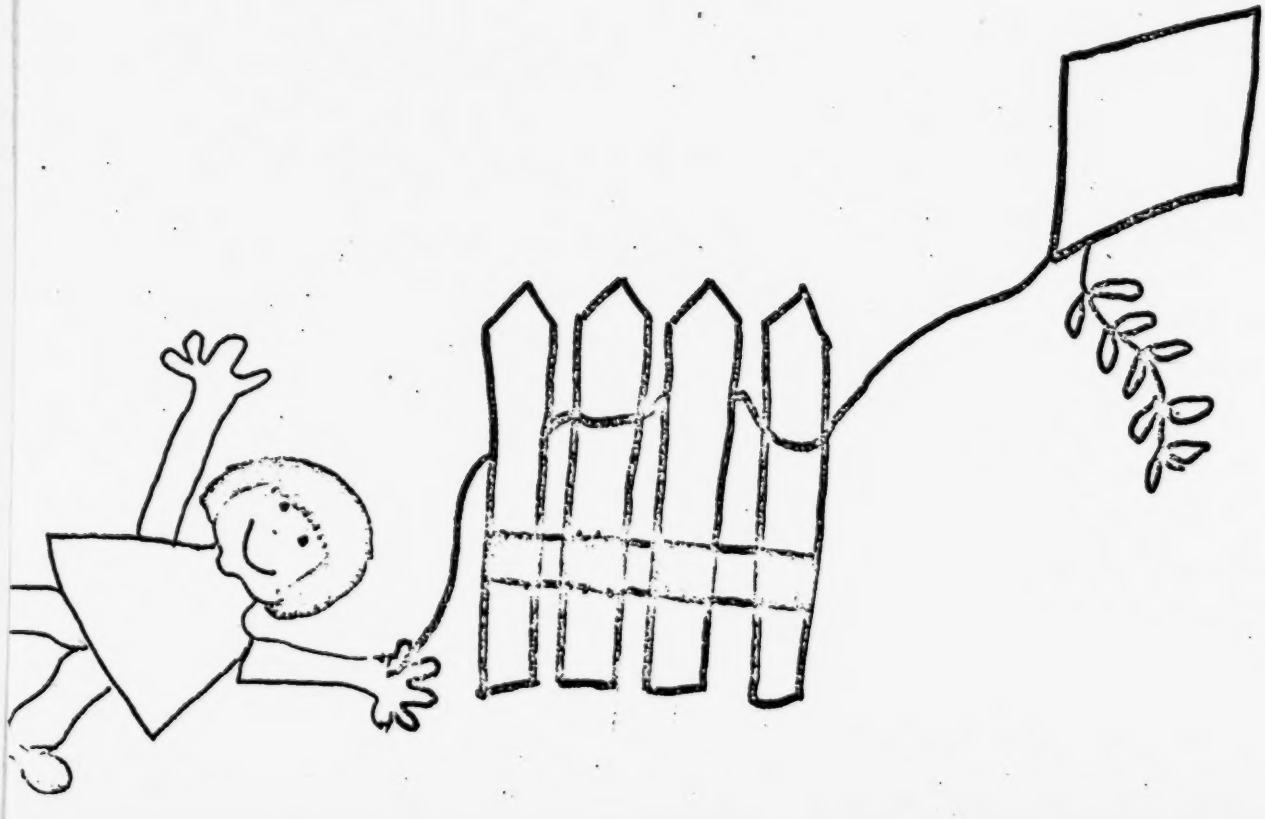


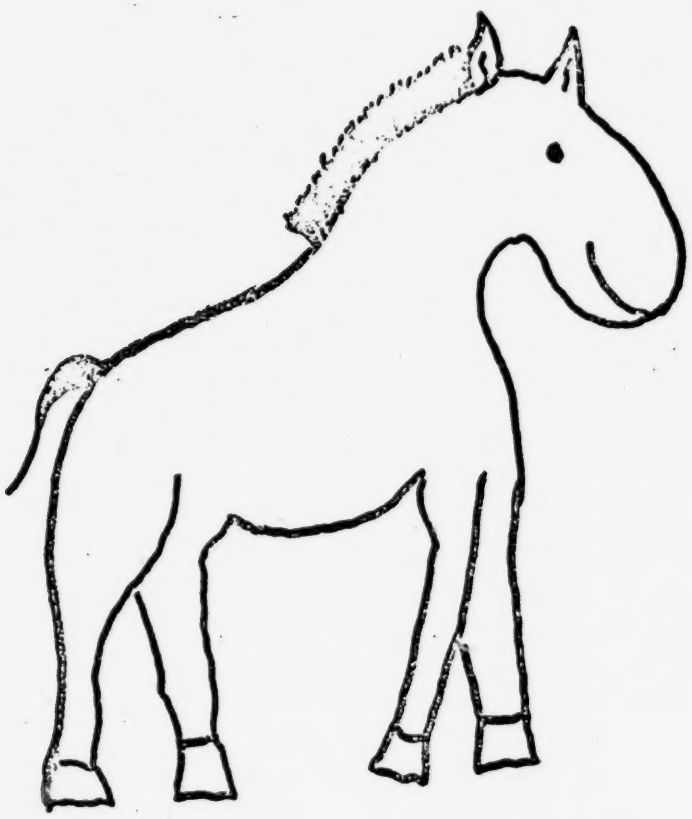
Figure 1. Showing the Effect of Each Treatment at Each of Three Grade Levels.

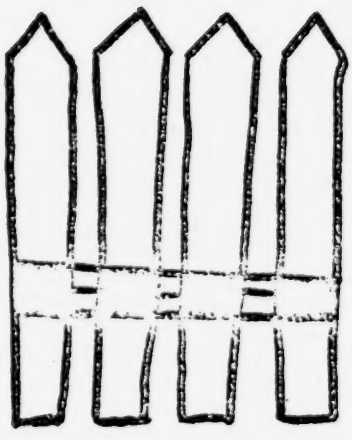
APPENDIX A: MATERIALS

Stimulus	Responses	
Training or Practice:		
Table	Baby	Glass
Elephant	Car	Football
Star	Man	Swing
Experimental:		
Fence	Kite	Girl
Sailor	Hose	Boot
Shoe	Pie	Dog
Bicycle	Frog	House
Airplane	Pig	Balloons
Horse	Cup	Umbrella
Bird	Bed	Apple
Duck	Rope	Wagon
Sled	Horse	Cake
Bathtub	Whale	Brush
Egg	Hand	Hat
Boy	Jar	Ladder
Scissors	Woman	Chain
Shovel	Bear	Leaves
Bell	Hammer	Policeman









APPENDIX B: INSTRUCTIONS

Combined Condition

Training

We're going to play a game with pictures. We're going to remember pictures a special way.

Here's a picture of a Table, a Baby, and a Glass, (Show unitized picture of Baby on Table pushing Glass off table). These things are doing something together. Can you tell me what they are doing? (If S does not focus on relations, ask him specific questions i.e., What is the Baby doing to the Glass? Where is the Baby?) (Remove picture). Can you remember the picture? What is happening in the picture?

Here's a picture of the Table. (Show stimulus picture). Think of the picture we just saw. Can you tell me the other things in the picture?

Here's a picture of an Elephant, a Car, and a Football. (Show unitized picture of Elephant driving Car over a Football). They are doing something together too. What is the Elephant doing to the Car? What's the Car doing to the Football? (Remove picture). I want you to draw the picture you just saw. It doesn't have to be neat -- draw it as fast as you can. (Three circles will do as long as S can identify them and describe their interaction). OK, look at your picture and show me what the things are doing together. (Ask specific questions about relations, as above).

(Show picture of Man on Swing eating a Star). Look at this picture. (Name items). What's the Man doing to the Star? Where is the Man sitting? I'd like you to draw this picture too. OK, what are the things doing together in your picture? (Ask specific questions as above).

Let's see if you can remember the pictures.

I) (Show Table) Think of the picture we saw with the Table in it. What are the other things in the picture?

II) (Show Elephant as cue) Same question
III) (Show Star as cue) Same question

Experimental Trials

That's very good! You really know how to remember pictures. Let's play the game with some more pictures. I'll tell you what the pictures are and you try to remember what they are doing together.

(Present each of the 15 unitized picture sets one at a time. Name the items and tell S to "try to remember what the things are doing together." Total time per picture set: 20 seconds)

Cued-Recall Test

Present each of the 15 cue pictures, one at a time, in the following manner:

Here's a picture of the _____. Think about the picture with _____in it. What are the other things in the picture with _____? (Allow 15 seconds for a response).

Post-Test Questioning

You did very well on those pictures! How did you remember so many of them? Did you do anything special to try to remember the pictures? How did you remember what went with _____? What did you do when I showed you the picture with _____in it? Can you remember what was happening in the picture with _____? (Ask these questions about at least four specific test pictures).

Relational Imagery Training Condition

Training

We're going to play a game with pictures. We're going to remember them a special way. We're going to make up pictures of things doing something together.

Here is a picture of a Table, a Baby, and a Glass. (Show separated picture containing these three items side by side). The way to remember these is to make up a picture of them doing something together. I made up a picture in my mind but I drew it so you could see it. (Show unitized picture of Table, Baby, and Glass). The things in my picture are doing something together. Can you tell me what they are doing? (If S does not get relation, ask him specific questions i.e., what is the Baby doing to the Glass? Where is the Baby?) (Remove picture). Can you remember my picture? What is happening in the picture?

Here's a picture of the Table. (Show stimulus picture). Think of the picture you just saw. Can you tell me the other things in the picture?

Here's a picture of an Elephant, a Car, and a Football. (Show separated picture of these three items). These things aren't doing anything together. Don't make up pictures like this. Do you think you could make up a better picture with these things doing something together? Why don't you try it. (If S comes up with unrelated picture, ask him to try again to make up one picture of them doing something together. Help him if necessary i.e., what could you have the elephant doing to the car? etc.)

I want you to draw the picture you just made up. It doesn't have to be a neat picture--draw it as fast as you can. (Three circles will do as long as S can identify them and describe their interaction). OK, look at your picture and tell me what the things are doing together. (Ask specific questions about relations).

(Show separated picture of Man, Star, and Swing). See if you can make up a picture of these three things doing something together. You don't have to tell me right away. Just try to make up a good picture of the things doing something together. Your picture doesn't have to be real, you can make it as silly as you wnat. (Allow 20 seconds). Did you make one? (If not, ask him to try again) Would you quickly draw it for me? OK, look at your picture. What are the things doing together in your picture? (Discuss relations with S, make sure he is not hesitant to create unrealistic relations, prompt him if necessary to produce an inter-related picture of all three items.)

Let's see if you can remember the pictures.

I) (Show Table). Think of the picture I made up with the Table in it. What are the other things in the picture?
II) (Show Elephant as cue) same question
III) (Show Star as cue) same question

Experimental Trials

That's very good! You really know how to remember pictures. Let's play the game with some more pictures. I'll tell you what the things are. You try to make up a picture of them doing something together. Will you try to do that?

(Present each of the separated picture sets one at a time. Name the items and tell S to "try to make up a picture of the three things doing something together." If he comes up with one immediately, tell him to think of the picture he made up and to try to remember what the things are doing together. If he starts to tell you about his creation, tell him to remember it so he can tell you afterwards. Total time per picture set: 20 seconds).

Cued-Recall Test

Present each of the 15 cue pictures, one at a time, in the following manner:

Here's a picture of the _____. Think of the picture you made up with _____in it. What are the other things in your picture with _____? (Allow 15 seconds for a response).

Post-Test Questioning

You did very well on those pictures! How did you remember so many of them? Did you do anything special when you looked at the pictures? How did you remember what went with _____? What did you do when I showed you the picture with _____in it? Did you make up a picture with _____in it?

(Ask these questions about at least four specific test pictures)

Unitized Picture Condition

Practice

We're going to play a game with pictures. I'm going to show you some pictures and I want you to try to remember them.

Here's a picture of a Table, a Baby, and a Glass (Show unitized picture). Try to remember these three pictures (20 seconds).

Here's a picture of the Table (show stimulus picture). What are the other things that go with Table? Very good!

Let's practice with some more pictures. This is a picture of an Elephant, a Car, and a Football. (Show unitized picture). Try to remember these three pictures. (20 seconds).

Here's a picture of a Man, a Star, and a Swing (Show unitized picture). Try to remember these three pictures too. (20 seconds).

OK, let's see how many pictures you can remember.

I) (Show Table) Can you tell me the other things that go with Table?
II) (Show Elephant as cue) same question
III) (Show Star as cue) same question

Experimental Trials

That's very good! You really know how to remember pictures. Let's play the game with some more pictures. I'll tell you what the things are. You try to remember them.

(Present each of the 15 unitized picture sets, one at a time. Name the items and tell S to "try to remember them." Total time per picture set: 20 seconds).

Cued-Recall Test

Present each of the 15 cue pictures, one at a time, in the following manner:

Here's a picture of the _____. What are the things that go with _____? (Allow 15 seconds for a response)

Post-Test Questioning

That was pretty hard but you did very well on those pictures! How did you remember so many of them? Did you do anything special to try to remember the pictures? How did you remember what went with

_____? What did you do when I showed you the picture with _____ in it? Can you remember what was happening in the picture with _____? (Ask these questions about at least four specific test pictures).

Control Condition

Practice

We're going to play a game with pictures. I'm going to show you some pictures and I want you to try to remember them.

Here's a picture of a Table, a Baby, and a Glass. (Show separated picture with Table, Baby, and Glass side by side). Try to remember these three pictures. (20 seconds)

Here's a picture of the Table (show stimulus picture). What are the other things that go with Table? Very good!

Let's practice with some more pictures. This is a picture of an Elephant, a Car, and a Football (show separated picture). Try to remember these three pictures (20 seconds).

Here's a picture of a Man, a Star, and a Swing. (Show separated picture.) Try to remember these three pictures too (20 seconds).

OK, let's see how many pictures you can remember.

I) (Show Table) Can you tell me the other things that go with Table?

II) (Show Elephant as cue) same question.

III) (Show Star as cue) same question.

Experimental Trials

That's very good! You really know how to remember pictures. Let's play the game with some more pictures. I'll tell you what the things are. You try to remember them.

(Present each of the 15 separated picture sets, one at a time. Name the items and tell S to "try to remember them." Total time per picture set: 20 seconds.)

Cued-Recall Test

Present each of the 15 cue pictures, one at a time, in the following manner:

Here's a picture of the _____. What are the things that go with _____? (Allow 15 seconds for a response.)

Post - Test Questioning

That was pretty hard but you did very well on those pictures! How did you remember so many of them? Did you do anything special to try to remember the pictures? How did you remember what went with _____? What did you do when I showed you the picture with _____ in it? (Ask these questions about at least four specific test pictures.)

22. R. Bruininks & J. Rynders. Alternatives to Special Class Placement for Educable Mentally Retarded Children. Occasional Paper #6. March, 1971. (Focus on Exceptional Children, 1971, 3, 1-12)

23. J. Turnure, S. Larsen, & M. Thurlow. Two Studies on Verbal Elaboration in Special Populations I. The Effects of Brain Injury II. Evidence of Transfer of Training. Research Report #17. April, 1971.

24. D. Moores. Recent Research on Manual Communication. Occasional Paper #7. April, 1971. (Keynote Address, Division of Communication Disorders, Council for Exceptional Children Annual Convention, Miami Beach, April, 1971).

25. D. Moores. An Investigation of the Psycholinguistic Functioning of Deaf Adolescents. Research Report #18. May, 1971. (Exceptional Children, May, 1970, 36, 645-652).

26. G. Siegel. Three Approaches to Speech Retardation. Occasional Paper #8. May, 1971.

27. M. Thurlow & J. Turnure. Mental Elaboration and the Extension of Mediational Research: List Length of Verbal Phenomena in the Mentally Retarded[1]. Research Report #19. June, 1971.

28. R. Bruininks, T. Glaman, & C. Clark. Prevalence of Learning Disabilities: Findings, Issues, and Recommendations. Research Report #20. June, 1971. (Presented at Council for Exceptional Children Convention, Miami Beach, April, 1971).

29. J. Turnure & S. Larsen. Outerdirectedness in Educable Mentally Retarded Boys and Girls. Research Report #21. September, 1971.

30. A. Taylor, M. Josberger, & J. Knowlton. Mental Elaboration and Learning in Retarded Children[1]. Research Report #22. September, 1971. (Mental Elaboration and Learning in EMR Children[1], American Journal of Mental Deficiency, 1972 in press.)

31. W. Bart & P. Krus. An Ordering-Theoretic Method to Determine Hierarchies Among Items. Research Report #23. September, 1971.

32. A. Taylor, M. Josberger, & S. Whitely. Elaboration Training and Verbalization as Factors Facilitating Retarded Children's Recall. Research Report #24, October, 1971.

33. J. Turnure & M. Thurlow. Verbal Elaboration and the Promotion of Transfer of Training in Educable Mentally Retarded. Research Report #25. November, 1971.

34. S. Samuels. Attention and Visual Memory in Reading Acquisition*. Research Report #26, November, 1971.

35. S. Samuels. Success and Failure in Learning to Read: A Critique of the Research. Occasional Paper #9. November, 1971. (In M. Kling, the Literature of Research in Reading with Emphasis on Models, Rutgers University, 1971).

36. D. Moores & C. McIntyre. Evaluation of Programs for Hearing Impaired Children: Progress Report 1970-71. Research Report #27, December, 1971

37. J. Turnure & M. Thurlow. Verbal Elaboration Phenomena in Nursery School Children[1]. Research Report #28. December, 1971.

38. F. Danner & A. Taylor. Pictures and Relational Imagery Training in Children's Learning[1]. Research Report #29. December 1971.